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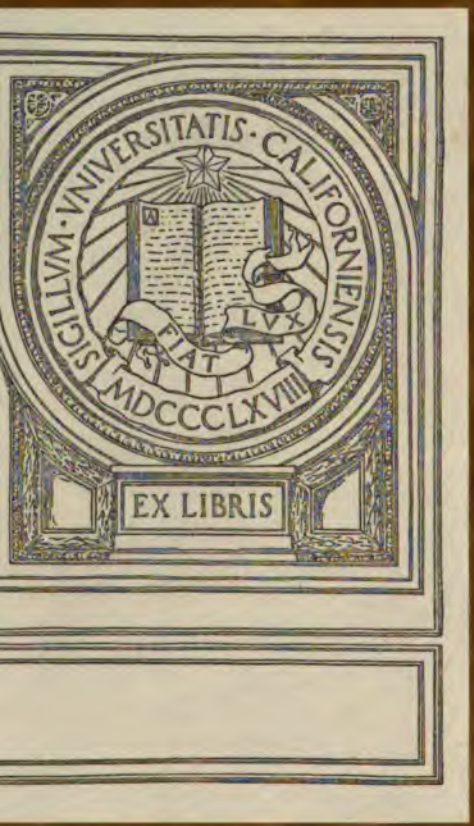
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THE NAVIGATION OF THE LAKES

AND

Navigable Communications Therefrom to the Seaboard,

AND TO THE MISSISSIPPI RIVER,

AND

RELATION OF THE FORMER

TO THE

LINES OF RAILWAY LEADING TO THE PACIFIC.

By EDWIN F. JOHNSON,
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THE NAVIGATION OF THE LAKES, ETC.

THE subject which it is now proposed to examine is one of so great importance in a commercial and political view, that no apology is needed for inviting attention to it.

The character of the St. Lawrence chain of waters, their connection with the navigable routes to the seaboard, and their relation to the navigation of the Mississippi and its branches, has been the theme of so much that has been said and written within the last fifty or sixty years, that it may be deemed presumptuous to endeavor to add to the amount of information already possessed. All therefore that is intended in the present essay is to present, if possible, the subject in such a light as to render its importance more apparent and deserving the attention and serious consideration of the American public.

The two great drainage basins of the St. Lawrence and the Mississippi, which pour their surplus waters into the Atlantic at points so remote as the gulfs of Mexico and St. Lawrence, approach each other in the interior, so that for a distance of over twelve hundred miles their waters interlock and they have the same boundary.

These basins differ greatly in character, producing an equally marked difference in the navigation afforded by each. The chain of St. Lawrence waters is characterized by a series of fresh water lakes unparalleled in extent and elevated from one hundred to six hundred feet above the level of the Ocean. At a distance of nearly two thousand miles from the Gulf of St. Lawrence is the largest of these lakes, Lake Superior, elevated six hundred feet above the sea, the surplus waters of which form the St. Mary's river and its eastern extremity.

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This river, after descending twenty-three feet, nearly, enters Lake Huron which is elevated five hundred and seventy-seven feet above the sea.

Upon a level with this lake, and connected with it by the straits of Mackinaw, is Lake Michigan.

The two last named lakes find an outlet by the St. Clair river at the southern extremity of Lake Huron, into St. Clair Lake. This latter discharges by the Detroit river into Lake Erie which has an elevation above the sea of five hundred and sixty-seven feet.

Lake Erie has for its outlet the Niagara river, which has a descent to Lake Ontario of 331 feet, nearly one half of which is vertical forming the grand falls of that river. From Lake Ontario, which is elevated two hundred and thirty-six feet above the sea, flows the St. Lawrence river proper, which, after a descent of 223 feet, meets the tides of the sea at Montreal thirteen feet above the sea level, that level not being attained until the river enters Lake St. Peters.

The St. Lawrence in its course from Lake Ontario to Montreal passes through two lesser lakes, formed by an expansion of its surface, viz.: Lake St. Francis, elevated 141 feet, and Lake St. Louis 59 feet above the sea level.

In addition to the lakes and rivers named, there are other waters in the St. Lawrence basin so situated as to be able to perform, or are now performing, an important part in the internal navigation of the country.

These are Lake Nippissing elevated sixty feet, nearly, above Lake Huron, and discharging its surplus waters by the French river into that lake. The Ottawa river connecting by one of its mouths with the St. Lawrence in Lake St. Louis on the southeast side of Montreal Island, a large and noble stream, stretching far into Northern Canada, and reaching by its Matewan branch to within four and a half miles of Lake Nippissing. Lake Simcoe discharging into the Georgian Bay of Lake Huron by the Severn river and elevated 137 feet above the latter lake, and Lake Champlain ninety-six feet above the sea, having for its outlet the Sorel or Chambly river, which enters the St. Lawrence at the head of Lake St. Peters

and a group of lakes in western New York, which have their outlet into Lake Ontario by the Oswego River, the easternmost of which, Lake Oneida, is elevated one hundred and twenty feet above Lake Ontario.

The waters above described lie partly within the Canadas, and partly within the States. Of the lakes named, Michigan, Champlain and Oneida, lie wholly within the States. Superior, Huron, St. Clair, Erie and Ontario, lie partly in the States and partly in Canada; and the others named are Canadian lakes and their outlets, including that of Lake Champlain, are Canadian rivers.

The great difference in elevation of the lakes, as described, indicates that the rivers connecting them or flowing from them, have a descent in their natural condition unsuited to navigation. This is true of all of them excepting the St. Clair and Detroit rivers.

The obstacles to navigation in the others have been overcome to a certain extent. The descent from Lake Superior to Lake Huron is overcome, eighteen feet of it, by a canal one mile nearly in length, having twelve feet depth of water, with two locks of eight to ten feet lift each, three hundred and fifty feet length of chamber, and seventy feet wide.

Between Lake Huron and Lake Erie, at what are called the St. Clair Flats, a dredging of the channel has been found necessary to secure ten feet depth of water at the lowest stage of Lake Huron, and this must be repeated at still greater cost, the bottom being an indurated marl, to secure eleven to twelve feet, and here it may be said, once for all, that the surface of the great lakes varies from four to about five or six feet in extreme cases, depending upon the rains and snows in their basins, and amount of evaporation. These changes culminate, it is said, with some regularity every six and one third years. The period from the maximum or minimum to the next maximum or minimum, being twelve and two-thirds years nearly. Their surface levels at their outlets and at other points, also vary with the direction and force of the winds that sweep over their surface, and when thus disturbed, currents are formed in recovering their equilib-

rium, which are plainly perceptible to those engaged in their navigation.

These lakes are remarkable for their large size, compared with the dimensions of the basins in which they are situated. They occupy full one-third of the whole surface. The discharge from them down the St. Lawrence does not probably exceed the one-fourth to the one-third part of the rain fall in their basins, a discharge which would be greatly lessened, but for their elevation and high northern position of the largest of their number, both of which circumstances contribute greatly to lessen the evaporation.

Lake Erie is connected with Lake Ontario, in Canada, by the Welland Canal, which is forty-two miles extreme length, has ten feet depth of water, and locks 150 feet by 26½ feet, with lifts averaging ten to twelve feet. This canal was originally of much smaller dimensions. It has two termini on Lake Erie, the shortest line from lake to lake being twenty-eight miles.

Upon the St. Lawrence, from Lake Ontario to Montreal, short canals, seven in number, have been constructed at places where the river has too great a descent for navigation. These canals have nine feet depth of water, locks, 200 feet by 50 and 55 feet, and they have an extent in the aggregate of 41 miles or 32½ miles to Lake St. Louis at the junction of the Ottawa with the St. Lawrence.

This distance of 32½ miles is made up of six separate canals in the order following, commencing from Lake Ontario.

1.	Galop's, length 2 miles, lockage, -	- 8 feet.
2.	Point Iroquois, length 3 miles, lockage,	6 feet.
3.	Rapid Plat, length 4 miles, lockage, -	11½ feet.
4.	Farren's Point, length ¾ mile, lockage, -	4 feet.
5.	Cornwall, length 11½ miles, lockage,	48 feet.
6.	Beauharnois, length, 11¼ miles, lockage,	82½ feet.
	Total length, 32½ miles, lockage, -	160 feet.

The first four of these, canals having an aggregate length of 9¾ miles, and 29½ feet of lockage, are not used by vessels

descending, the depth of water in the river being ample for their safe passage, and the channel broad. This fact we shall have occasion to refer to hereafter.

Upon the outlet of Lake Champlain, is the Chambly Canal, 11½ miles long, with locks 120 by 24 feet, and six feet depth of water, overcoming the fall (about 65 feet,) at the Chambly rapids, and below is a dam at St. Ours, 12 miles from the St. Lawrence, with a lock by which the navigation of the river is improved so as to insure 6 to 7 feet depth of water.

At the distance of about 110 miles from the mouth of the Ottawa, is the junction, at Bytown, or Ottawa City, of the Rideau Canal with that river.

This improvement extends to Lake Ontario at Kingston, 127 miles, of which 57 miles only is canal, the remainder being river and lake navigation. The summit level is 165 feet above Lake Ontario, the total lockage 455 feet, and locks 127½ feet by 46 feet, with 5 to 5½ feet depth of water. Between Bytown and Montreal are three short canals, the Carillon, Blondeau, and Grenville, to pass obstructions on the Ottawa river, with locks 110 by 30 feet, and five feet depth of water.

From Lake Erie, at Buffalo, to tide-water at Albany, is the Erie Canal, of New York, located for over 150 miles within 7 to 25 miles of the south shore of Lake Ontario, having 7 feet depth of water, 350 miles in length, with a rise and fall of 644 feet, overcome by locks, the chambers of which are 110 by 18 feet. Connecting with this canal at Syracuse, is another leading to Oswego on Lake Ontario, of the same dimensions and size of locks, and from this latter there is a smaller navigation by the way of the Oneida river and lakes to the Erie Canal at Oneida Creek, forming, in conjunction with the Erie Canal and Oswego river, a navigation between Lake Ontario and the Hudson river, 204 miles in length, and having a rise and fall of 614 feet. This navigation can be enlarged and improved, and the distance, it is supposed, lessened about 9 or 10 miles.

From Lake Champlain is the Champlain Canal, of the same dimensions with the Erie Canal, connecting with the

latter nine miles from Albany, having a length of 62 miles, and a rise and fall of 179 feet, or 204 feet to Albany. The summit level of this canal is 150 feet above tide.

The above comprise the improvements made and in operation, leading from the lakes named to the eastern seaboard, omitting those in the valley of the Susquehannah. These improvements are all situated in, and owned in the Canadas, except the New York and Sault St Marie Canals.

To the West the navigation of the lakes is connected with that of the Mississippi by a Canal from Cleveland to Portsmouth on the Ohio river, 310 miles long. Another from the Maumee river to the Ohio river, (The Wabash and Erie Canal,) 467 miles in length.*

To these are to be added the Illinois and Michigan Canal, from Chicago on Lake Michigan to the Illinois river, and the improvement from Green Bay, in Wisconsin, to the Wisconsin river. The two latter named being the most prominent and important, as connecting the navigation of the lakes with the Mississippi by very short lines will alone be considered. The Illinois and Michigan Canal has a length of 96 miles, with 6 feet depth of water, locks 110 by 18 feet, and a rise and fall of 158 feet. Its summit level is 8 feet above Lake Michigan, and it has 17 locks of about 9 feet lift each. From the junction of this Canal with the Illinois river to the mouth of the latter upon the Mississippi the descent is 32 feet in 216 miles, making the elevation of the Mississippi at that point above the sea 400 feet, nearly, and the rise and fall from Chicago to the same point, 190 feet.

The line from Green Bay in Wisconsin follows the Fox river 46 miles, in which distance it rises 160 feet to Winnebago lake, and after passing through a portion of the lake (16 miles) enters the Upper Fox river which it follows 110 miles to within two miles of the Wisconsin river, where is a canal connecting the two, the ascent from Lake Winnebago to the divide of the rivers being 63 feet. From this point the

*Two Canals, the Genessee Valley, in New York, and another leading from Erie in Pennsylvania, connect with the Alleghany river at points, where there is, at present, only a descending navigation on that river.

descent to the Mississippi by the Wisconsin river is 75 feet nearly, viz.: 45 feet in the first 55 miles and 30 feet in the remaining 65 or 70 miles, making the total rise and fall from Green Bay to the Mississippi 298 feet nearly, and the elevation of the Mississippi at the point of junction 725 feet above the sea. The locks upon this line are 160 by 35 feet, and the entire length is 295 miles from Green Bay to the Mississippi.

In respect to the larger lakes and their navigable connections with the seaboard, such is the character of the entrances to the several harbors upon the former, and depth of water in the St. Clair river, that vessels navigating them are limited to a maximum draft of about ten feet, the depth of water upon the bars and in the St. Clair river not much exceeding that amount in the ordinary condition of the lakes. The Sault St. Marie canal, we have seen, is adapted to vessels having a draft of 11 feet; vessels of this description can navigate, with the required improvement on St. Clair river, the large surface covered by the lakes Superior, Huron, Michigan and Erie, which have in the aggregate a shore line of nearly 5000 miles. These lakes receive from the vast and fertile regions lying to the west and southwest in the valley of the Mississippi, the immense amount of produce which those regions furnish, and must continue to furnish for the Atlantic and European markets, but it cannot reach the former in such vessels as are best suited to the navigation of the lakes, but must be trans-shipped at Buffalo and other points, and passed on in smaller vessels in a mode less favorable for cheap transit, and in consequence there is imposed upon both the producer and the consumer a burden which should be removed if possible.

The New York canals with only a depth of 7 feet can pass vessels of only about 6 feet draft and 17 feet width of beam, and the Welland and St. Lawrence canals, although the locks are much larger, limit the draft to 9 and 8 feet. The latter if of ample size in all respects, would not meet the wants of the commerce of the lakes, which can only be properly provided for and accommodated by the construction or opening of channels which shall lead most directly and expeditious-

ly to those cities upon the seaboard as New York, Boston, &c., which now control and, for all time, probably, must continue to control the American trade of the North Atlantic.

So far, therefore, as regards the navigation of the lakes the great desideratum is, first, to render Lake Ontario accessible to the larger vessels navigating the upper lakes, and secondly, to open from the latter to the eastern seaboard a navigation which shall be the cheapest and best possible, a navigation which shall be suited to the lake harbors and which will permit lake going vessels of the class most profitable for transportation, to deliver their cargoes unbroken upon the seaboard, and to take back from the latter and the region adjacent, whatever the trade between the East and the West shall require to be conveyed.

An examination of the country without regard to national boundaries, leads to the conclusion that a navigation, connecting the lakes named with the Eastern seaboard, to be the best and cheapest possible must be opened upon one or all of the three following routes.

First. The enlargement and improvement of the navigation from Lakes Erie and Ontario to the Hudson.

Second. The improvement of the navigation of the St. Lawrence, the connection of the latter river by canal with Lake Champlain, and improvement of the communication from the latter to the Hudson.

Third. The opening of a communication from Lake Huron to the Hudson by the route of the French and Ottawa rivers, connecting with the last named line near Caughnawaga on the St. Lawrence.

Fourth. The opening of a communication from the Georgian Bay of the same lake direct to Lake Ontario, thence connecting with the lines mentioned leading to the seaboard from that lake.

Necessary to the first of these improvements is a better communication between Lakes Erie and Ontario than is now offered by the Welland canal, a communication which will enable vessels of the larger class to pass easily from one lake to the other. This improvement should be placed in the

vicinity of the Niagara river where the distance is the least possible, and where the difference in elevation of the lakes can be overcome in the shortest time and with the least expense. The ground for this purpose has been instrumentally examined by competent engineers, all of whom have pronounced in favor of the practicability of the undertaking. The last survey was for a marine railway as a substitute for a canal which was also pronounced practicable. These surveys all commence at Schlosser on the east side of the river and terminate with two or three exceptions at Lewiston, the distance to the latter place being about eight miles.

Examinations and surveys made by the Canadian authorities, some ten years since, show that a canal of the desired dimensions can be constructed over very favorable ground from the St. Lawrence river to the outlet of Lake Champlain. The level of this outlet at St. Johns, the northern limit of the natural navigation from that lake, meets the St. Lawrence at a point 31 feet above Lake St. Louis, or 51 feet below Lake St. Francis, on the line of the Beauharnois canal. A level canal from this latter point will run nearly parallel with the south shore of Lake St. Louis to near Caughnawaga before taking a more eastwardly course. At Caughnawaga a connection with the St. Lawrence at Lake St. Louis is indispensable to accommodate the trade of the Ottawa valley, and the city of Montreal. The surveys show that the line of canal from Caughnawaga to St. Johns may be shortened ten miles, making the entire distance 25½ miles, by passing a summit 37½ feet above the river at St. Johns. This summit is attained at a point four miles from Caughnawaga, which point is the proper place for the junction of the line 16 miles in length from Beauharnois. A canal thus constructed will connect with, and be fed from, the Beauharnois canal, at a point 14 feet below the level of Lake St. Francis, or 68½ feet above Lake St. Louis, and the current in it will be in a direction favorable to the descending trade.

From St. Johns to Lake Champlain there is a good navigation in the lowest stage of the lake for vessels drawing 7 to 8 feet water, which may be increased by dredging in soft

material in three or four places to 11 or 12 feet. This lake varies about 6 to 7 feet in its level from the same causes which influence the other lakes. The alternations of high and low water are however more frequent from its smaller size and great elevation of the country on either side of it.

A survey of the Champlain canal made some years since, and examination of the ground over which it passes for a railroad, by the writer, show that a larger navigation, a navigation having 12 feet depth of water, may, without difficulty, be formed from Lake Champlain to the Hudson river, to be fed like the present canal from that river.

The route described from Lake Huron via French river to the Ottawa and by the latter river to the St. Lawrence, has recently been instrumentally examined. From this examination it appears that a navigation may be opened, by an improvement of the French, and Matewan and Ottawa rivers, which will pass vessels drawing 11 feet water from Lake Huron to the St. Lawrence at Lake St. Louis. The summit level upon this line is 83 feet above Lake Huron, and the distance between the waters of Lake Nippissing or French river and the Matewan branch of the Ottawa only 4½ miles, and only 53 miles of independent, and 13 miles of enlarged canal, with the necessary locks, guard locks and dams, are needed, as supposed, to perfect the navigation the entire distance of 422 miles to the St. Lawrence at Lake St. Louis; the remaining portions being natural navigation with ample depth of water.

At the junction with the St. Lawrence, on the southeast side of Montreal island, this route meets the canal proposed and described above from Caughnawaga to the outlet of Lake Champlain.

From Lake St. Louis a connection already exists with tide water at Montreal by means of the Lachine canal, 8¼ miles long, which overcomes an elevation of 46 feet. This canal may be enlarged so as to give 12 feet depth of water, as may also the series of St. Lawrence canals westward to Lake Ontario.

From the Georgian Bay of Lake Huron to Lake Ontario, surveys have been made, by the way of Lake Simcoe, disclosing two routes terminating at Toronto. The highest or summit ground is about 700 feet above Lake Ontario, and as Lake Huron is 341 feet above the same lake, this summit would give 1060 feet rise and fall between the two lakes. This it is supposed can be greatly lessened. This distance is about 100 miles, and the main summit is about 25 miles from Lake Ontario.*

For the purpose of comparing the several routes named, we have collected all of the important facts relating to each, viz.: their length, extent of lake navigation, and of unobstructed river navigation, the rise and fall upon each, and extent of artificial canal, now in use and required, and other details, a portion of which have been given above. These facts and details have been derived from actual measurements, and from the most authentic sources. The routes described all converge or meet at Albany on the Hudson, and hence that city will be considered as the terminus on the seaboard. To make New York city the terminus would not change materially the relation of the routes as it would only add 150 miles of unobstructed river navigation to each. Neither would their relation be changed if it should be necessary in order to obtain the required depth of water in the Hudson to carry the improvement in the navigation to some point below the city of Albany.

For the Lake Superior trade the initial or starting point, a point which the entire eastward bound trade of that lake must pass, is assumed at the lower end of Sugar island at the mouth of the St. Mary's river. For Lake Michigan the point is placed at the straits of Mackinaw. For Lake Huron it is supposed to be at the mouth of French river, the head of the Georgian Bay, and at Sarnia at the entrance into the

*For a general view of the canals and navigable rivers and lakes of the Union and their relation to the commerce and prosperity of its several sections, the reader is referred to the excellent letters of the Hon. Rob't J. Walker, T. Y. Howe, and John A. Poor and others, to the Canal Convention, held at Chicago in 1863, published in the proceedings of the Convention.

river St. Clair. For Lake Erie at Buffalo, and for Lake Ontario at Oswego and Ogdensburg.

The lakes and their outlets and canals as above described, including the Upper Mississippi and its branches are all closed by ice for a portion of the year. The Erie canal is opened for navigation in the spring about the 23d of April. This is the average for 41 years ending in 1864; the earliest date being March 27th, and latest May 6th. Lake Erie at Buffalo is clear of ice about the 16th of April; this is the average for 38 years ending as above; the earliest date being the 7th of March; the latest the 16th of May. Navigation upon the canals continues for about seven months in the year very nearly, that of the lakes is longer, ending first upon Lake Superior, and then upon the northern parts of Lake Huron and Michigan. The Hudson river from Troy or Albany to New York is always open as early as the canals, and this is the case with the Upper Mississippi and its branches unless Lake Pepin is occasionally an exception.

NAVIGABLE ROUTES FROM THE LAKES TO THE EASTERN SEABOARD.

LAKE SUPERIOR TRADE. Sugar Island, St. Mary's River to Albany, N. Y., Route.	Lake. mil's	Unobstructed River. mil's	Canal. mil's	Rise. feet.	Fall. feet.
1. *Lake Erie, Ontario, Oswego, and Erie Canal.*					
Sugar Island to Sarnia Outlet of Lake Huron,	260				
Sarnia to Buffalo,	265	55			10
Buffalo to Oswego,	135	27	8		281
Oswego to east end of Oneida Lake,	21	20	17	120	
Oneida Lake to Albany,			185	69	425
Total distance, 948 miles.	681	102	160	189	766
2. *Lake Erie and Erie Canal from Buffalo.*					
Sugar Island to Buffalo, as above,	525	55			10
Buffalo to Albany,			350	44	611
Total, 930 miles.	525	55	350	44	621
3. *Lake Erie, Ontario, St. Lawrence, and Champlain.*					
Sugar Island to Buffalo, as above,	525	55			10
Buffalo to Ogdensburg by proposed Niagara Ship Canal,	180	77	8		389
Ogdensburg to the outlet of Lake Champlain, St. Johns,	*74	*57			138
Outlet of Champlain at St. Johns to Burlington, Vt.,	42	26		6	
Total, 1044 miles.	747	232	65	6	487
Burlington, Vt., to Albany,	72		72	54	150
Total, 1188 miles.	819	232	137	60	637
4. *Ottawa River and Lake Champlain.*					
Sugar Island to the mouth of French River,	175				
Mouth of French River to Caughnawaga on St. Lawrence,	40	316	66	83	601
Caughnawaga to outlet of Lake Champlain, St. Johns,			26	70½	37½
St. Johns to Burlington, Vt.,	42	26		6	
Total, 691 miles.	257	342	92	159½	638½
Burlington, Vt., to Albany,	72		72	54	150
Total, 835 miles.	329	342	164	213½	788½
5. *Georgian Bay, Lake Ontario, Oswego, and Erie Canal.*					
Sugar Island to head of Georgian Bay,	270				
Georgian Bay to Toronto,	5	10	85	230	507
Toronto to Oswego,	140				
Oswego to Albany, as above,	21	20	152	189	425
Total, 708 miles.	436	30	237	419	995
6. *Georgian Bay, Ontario, St. Lawrence, and Champlain.*					
Sugar Island to Toronto, as above,	275	10	85	230	570
Toronto to Ogdensburg,	175	50			8
Ogdensburg to Burlington, Vt., as above,	42	100	57	6	138
Total, 794 miles.	492	160	142	236	716
Burlington, Vt., to Albany,	72		72	54	150
Total, 988 miles.	564	160	214	290	866

*Five miles are taken from the actual distance by canal and added to the distance by the river, for the reason that vessels in descending the river do not pass or make use of the four first canals, embracing a distance of 9½ miles. This change is made upon the St. Lawrence routes in all the computations which follow.

In a manner similar to the preceding the facts relating to the routes leading from each of the other lakes have been ascertained the details of which need not be given, as whatever is requisite for instituting a comparison between them is embodied in the table or summary which follows.

In column A, of the table, opposite each designated route, is given its total length in miles. In the next column, B, the extent in miles of lake and unobstructed river navigation. In column C, the extent in miles of canal. In column D, the total rise and fall in feet. In column E, the length of canal in miles which is considered equivalent to the total rise and fall. In column F, the estimated time of transit over each route in hours. In column G, the relative time and relative cost of transportation, the same numbers being found to represent both, under the proportions assumed in the estimate.

TABLE—COMPARISON OF ROUTES.

	ROUTE.	Length. mls.	Lake and unobstructed River. mls.	Canal. mls.	Rise and fall. feet	Extent of Canal, equivalent to rise and fall, 10 feet—1 mile. mls.	Time of passage, Canal 4 m. per hour, Lake and River 8 m. per hour. hrs.	Relative time and cost of transit. Ontario and Oswego route unity.
		A.	B.	C.	D.	E.	F.	G.
Lake Superior trade.	*Sugar Island to Albany.*							
	1. Lake Erie, Ontario, Oswego and Erie Canal,	943	783	160	955	96	162	1.
	2. Lake Erie, and Erie Canal from Buffalo,	930	580	350	665	67	177	1.09
	3. Lake Erie, Ontario, St. Lawrence and Champlain,	1188	1051	137	697	70	183	1.13
	4. Ottawa River and Lake Champlain,	885	671	164	1002	100	150	.93
	5. Georgian Bay, Ontario, Oswego and Erie Canal,	703	466	237	1414	142	153	.95
	6. Georgian Bay, St. Lawrence and Champlain,	938	724	214	1156	116	173	1.07
	Sugar Island to Burlington, Vt.							
	1. Ottawa River, and Lake Champlain,	691	599	92	798	80	118	.73
	2. Lake Erie, Ontario, and St. Lawrence,	1041	979	65	493	49	151	.93
Lake Michigan trade.	*Mackinaw to Albany.*							
	1. Lake Erie, Ontario, Oswego and Erie Canal,	953	793	160	955	96	163	1.
	2 Lake Erie, and Erie Canal from Buffalo,	940	590	350	665	67	178	1.09
	3. Lake Erie, Ontario, St. Lawrence and Champlain,	1198	1061	137	697	70	184	1.13
	4. Ottawa River, and Lake Champlain,	870	706	164	1002	100	154	.95
	5. Georgian Bay, Ontario, Oswego and Erie Canal,	713	476	237	1414	142	155	.96
	6. Georgian Bay, St. Lawrence, and Champlain,	948	734	214	1156	116	174	1.07
	Mackinaw to Burlington, Vt.							
	1. Ottawa River, and Lake Champlain,	726	634	92	798	80	122	.75
	2. Lake Erie, Ontario, and St. Lawrence,	1054	989	65	493	49	152	.93
Lake Huron trade.	*Sarnia to Albany.*							
	1. Lake Erie, Ontario, Oswego and Erie Canal,	683	523	160	955	96	129	1.
	2. Lake Erie, and Erie Canal from Buffalo,	670	320	350	665	67	144	1.12
	3. Lake Erie, Ontario, St. Lawrence, and Champlain,	928	791	137	697	70	151	1.17
	Mouth of French River to Albany.							
	4. Ottawa River, and Lake Champlain,	660	496	164	1002	100	128	.99
	Georgian Bay to Albany.							
	5. Ontario, Oswego and Erie Canal,	433	196	237	1414	142	119	.92
	6. Ontario, St. Lawrence, and Champlain,	668	454	214	1156	116	139	1.08
	Sarnia to Burlington, Vt.							
	1. Lake Erie, Ontario, and St. Lawrence,	784	719	65	493	49	118	.91
	Mouth of French River to Burlington, Vt.							
	2. Ottawa River, and Lake Champlain,	516	424	92	798	80	97	.75
Lake Erie trade.	*Buffalo to Albany.*							
	1. Lake Ontario, Oswego and Erie Canal,	363	203	160	945	95	89	1.
	2. Erie Canal,	350		350	655	66	104	1.17
	3. Lake Ontario, St Lawrence, and Champlain,	608	471	137	687	69	110	1.23
	Buffalo to Burlington, Vt.							
	1. Lake Ontario, St. Lawrence, and Champlain,	464	399	65	483	48	78	.88
Lake Ontario trade.	*Oswego to Albany.*							
	1. Oswego Canal, Oneida Lake, and Erie Canal,	193	41	152	614	62	59	1.
	Ogdensburg to Albany.							
	2. St. Lawrence and Lake Champlain,	343	214	129	348	35	68	1.15
	Ogdensburg to Burlington, Vt.							
	1. St. Lawrence and Lake Champlain,	199	142	57	144	15	36	.61

In computing the length of canal due to the rise and fall, we have adopted the customary relation for smaller sized canals, ten feet of rise and fall being supposed equivalent to one mile of canal. This proportion is based upon the supposition that the cost and maintenance of a lock of ten feet lift is equal to the cost and maintenance of one mile of canal, and that the time occupied in passing such a lock is equal to the time occupied in passing the mile of canal. This proportion is less true probably of large sized canals, such as now contemplated, but may be considered near enough for our purpose. The error, if any, will, we think, if corrected, rather increase than lessen the differences presented in the table. The cost of transportation upon natural waters, when estimated per ton per mile, varies so greatly, as the distance is more or less, that it is difficult, if not impossible, to frame a rule applicable to all cases which shall be strictly correct.

The assumption that the cost upon canal is double the cost upon lake and river for the same distance, is probably, from such facts as we have been able to obtain, the most favorable for the canal, and a similar remark may be made as to the estimate of time, for while eight miles is easily, and often made by steam vessels in the navigation of the lakes and rivers, four miles per hour is seldom made by them on canals.

If this is a correct conclusion the comparison which is presented in the table exhibits those lines which have a larger portion of canal in a too favorable light. The comparison also assumes that upon all of the routes the canals upon each have a size adequate to the passage of vessels of eleven feet draft of water. This probably will never be true of the Erie Canal, or at least of that portion of it from Buffalo to near Rome, and if made true from Rome to the Hudson it must be by a change of plan involving the reconstruction of almost the entire line. The plans heretofore proposed for enlarging this portion have not contemplated more than about one foot addition to the depth and 15 to 20 feet to the width, owing to the great cost and difficulty of enlarging beyond those

limits. This will make transhipment necessary at Buffalo and at Oswego or Oneida Lake, which will increase the expense and the time somewhat upon both, unless these are counterbalanced by the saving in the use of a lighter class of steam vessels, as compared with their tonnage, upon the canals and upon the Hudson river, or the use of steam tugs upon both, or the adoption of a cheaper and more expeditious mode of overcoming the elevation at the eastern extremity of the canal, where is concentrated two-fifths of the lockage upon it, or, of all combined. This latter change is deserving of the serious attention of all who are interested in the navigation of the Erie Canal.

As to the delay and cost of transhipment, that alone will not detract, except in a slight degree, from the superiority of the Oswego route, and will not affect the comparison between that route and that of the Erie Canal from Buffalo, since in the case of the latter, transhipment can not, under any circumstances, be avoided.

It will be seen that because of the proportions assumed between canal and lake and river, in estimating time and cost of transportation, that the percentage of advantage or disadvantage is the same for each, as shown in the table. That is, if there is a saving or loss of a certain percentage in time, there will also be a saving or loss of the same percentage in the cost of transportation.

It is proper to state that the table shows the relative time and cost of transportation upon the several routes upon the supposition that locks are used to overcome, in all cases, the rise and fall where assistance is required.

It should, however, be understood, in respect to the communication between Lakes Erie and Ontario that the great difference in elevation of the two is all to be overcome (such is the formation of the ground) in a very short distance, a circumstance not the most favorable for the adoption of the customary means of locks, but supposed to be favorable for the substitution of a marine railway or inclined plane for effecting the same object for the smaller class of vessels if not for the larger. If by the adoption of this substitute the time

and cost of passing vessels can be lessened, there will result a saving of time and cost upon all of the routes benefited by the improvement.

We have assumed the connection to be made between the St. Lawrence and Lake Champlain in such a manner as to accommodate equally the St. Lawrence and Ottawa routes. By leaving the St. Lawrence at a point higher up, the distance from Lake Ontario or Ogdensburg to Lake Champlain may be lessened without adding to the amount of lockage. Such a position, however, for the canal would add to its length and cost, and render necessary, ultimately, another canal from Lake St. Louis to accommodate both the valley of the Ottawa and the city of Montreal in their trade with the States. The route to the former passing, as will be seen by reference to the map, within nine to ten miles of the latter city.

From the results presented in the table the following conclusions are drawn, viz.:

That the best navigable route for the vast trade between the great lakes and the waters of the Hudson is the one by the way of Lake Ontario to Oswego, and thence by the Oswego river and Oneida lake to Albany, the difference being, for the Lake Superior and Lake Michigan trade, nine per cent. in favor of the Lake Ontario and Oswego route as compared with the route by the Erie canal from Buffalo; twelve per cent for the Lake Huron trade, and seventeen per cent. for the Lake Erie trade; and this, irrespective of any superiority which a marine railway may possess either as an auxilary or a substitute for overcoming the elevation at Niagara over the common method of locks.

That for a portion of this trade from the upper lakes the route by the way of the Ottawa river and Lake Champlain to the Hudson, possesses, if the proper connection is made with Lake Champlain, a nominal advantage over the route first above named, via Oswego, of about five to seven per cent as shown in the table, which, however, is nearly or quite counterbalanced by the fact of that route being in a foreign territory, and, from its greater elevation above the sea and higher northern position, more liable to obstructions from ice. Moreover, when the improvement shall be actually made, the

portion which is estimated as canal may, it is supposed, be somewhat increased, and no account is made in the table of the greater number of guard locks and obstructions from fluctuations in the level of the rivers, which must be greater on that route than upon the St. Lawrence.

As to the trade of Lake Ontario, the time and cost from Oswego to Albany is so much less than from the outlet of the lake by the way of Lake Champlain to the same point that the former route is clearly the best.

It appears, from the above comparison of routes, that if the one from the Georgian Bay of Lake Huron to Lake Ontario can be opened on as favorable ground as contemplated, it will form an important channel for a portion of the upper lake business. The lockage upon it as assumed in the table, exceeds the lockage at Niagara 469 feet, a difference which, under the mode of computation adopted, is equivalent to 47 miles of canal or 94 miles of lake and river navigation, an amount which deprives it of much of the advantage it has in actual distance.

The construction of this canal will not detract from, but add to, the importance of the routes via Oswego and by the St. Lawrence as already shown. The Georgian Bay is said to be longer obstructed by ice than the upper part of Lake Huron. As to the precise amount of this obstruction we are not fully informed, and cannot state its effect upon the navigable season. If the rise and fall or distance or both shall prove to be less than we have assumed, the difference in its favor will be correspondingly increased. If the summit can be reduced to the level of Lake Simcoe within reasonable limits of expense, it will make a difference in favor of this route of 8 or 4 per cent greater than is stated in the table.

In improving the navigation of the lakes and waters connected with them, regard should be had to their natural capabilities and the necessities of trade. The craft which experience shows to be in many particulars the best adapted to lake navigation is the screw propeller. Vessels of this description are increasing in number upon the lakes, and they must continue to increase, and rapidly, if a channel is opened for them

to tide water. Unlike other vessels their form and mode of propulsion is very well adapted to the navigation of the proposed canals and passage of the locks or railway planes should these latter be found advantageous. As now constructed very few of these vessels exceed 600 tons. One of the largest has a length of 234 feet drawing when loaded, ten and one-half feet, and its burthen is 850 tons, equal to 28,000 bushels of wheat. The size proposed for locks in the Congressional bill of last session, viz.: 275 by 45 feet with 12 feet depth of water is not too large for the Niagara improvement, neither is it, so far as regards the depth of water in the canal, more than is needful for the improvements leading from Lakes Ontario and Huron to the seaboard. Two feet difference in the depth upon the mitre sills of the locks and of the canals for this portion, with a corresponding increase in the width of the latter, is not too much to ensure a proper rate of movement to vessels, and in arranging the dimensions for the locks, which of necessity limit the size and form and draft of vessels, it should not be forgotten that the very great magnitude of the internal as compared with the external commerce of the country requires that the vessels and means used should be the best adapted to the purpose. Whatever system therefore is the best for the internal trade should not be interfered with or sacrificed in the expectation of a benefit to be derived from making it conform to the exigencies of ocean navigation.

The lakes and their connections offer a wide field for capital and enterprise, a field wide enough not to be materially benefited by assimilating to Ocean navigation in those particulars in which they naturally and necessarily differ. Locks of too large dimensions are costly to build and keep in repair, difficult to operate, require more time to pass vessels, and may be so large as to be a positive and serious disadvantage rather than a benefit to trade. They may have the effect to discourage individual enterprise by rendering a smaller class of vessels less profitable, and thus serve to throw the trade into the hands of a few comparatively and expose the country to the evil of monopolies. In the coast wise trade which is larger than the foreign trade of the country, vessels are em-

ployed of all sizes from 100 to 500 tons costing from $7,000 to $40,000, sums not so large as to prevent masters from becoming sole owners, or the owners of a major interest in each. These vessels would not be built if they were not required by public convenience, and as the navigation in which they are employed has a character similar to that of the lakes, with the single exception, that they have no locks to pass, or but rarely, and are not subjected to any loss or inconvenience in that respect, it is the more evident that vessels of similar tonnage will continue to be employed in large numbers upon the lakes.

These vessels will doubtless many of them become sea coasters during the winter months and will be constructed accordingly. These considerations are more particularly applicable, as stated, to the channels leading from the lakes to tide water. Lake Superior being already united with Lake Huron by a canal having 12 feet depth of water, vessels adapted to that depth can traverse the entire expanse of those lakes and of Lake Michigan, and with some further expenditure at the St. Clair Flats, the whole of Lake Erie.

This being the case, the short connection between Lake Erie and Lake Ontario should be of a character to bring Lake Ontario, with its 600 miles of shore line and 8,000 square miles of surface, upon the same navigable plane with the upper lakes, so that in conjunction with them it can perform its proper part in the internal trade of the country, from which it is now in a great measure excluded.

In this view there is a propriety in considering that the Niagara canal has an office to perform which makes it an exception to those other and longer channels made up of river and canal mostly, which connect the entire lake system, Lake Ontario included, with the seaboard. Lake Ontario is certainly entitled to special consideration from its great size, and from its position, reaching as it does half way from Lake Erie to tide water, and, also, from the railway lines leading from its eastern extremity to the seaboard, now amounting to four in number in operation, and two other important ones, the Sackets Harbor and Midland, in progress. These railways

and others leading from the lakes will necessarily participate largely in the trade and the more largely because of the slow movement in the confined channel of the canal, and hence it is a question worthy of consideration whether the amount needful to give the canals and their locks a depth and size suited to profitable ocean navigation, would not be better applied in giving to the former still greater width and depth to facilitate the more rapid movement of vessels upon them.

Because of the very slow movement upon the Erie canal, slower now than before its enlargement, freight for the interior which has a higher value in proportion to its weight or bulk than the seaward freight is now carried mostly upon the railways. Prior to the construction of the latter the proportion of the two on the Erie canal was as 1 to 4 or 5, now (1865) it is as 1 to 8.

The question of the relative cost of transportation upon the canals as proposed to be enlarged, and upon unobstructed natural waters is one of importance, and especially so in comparing and determining the merits of different routes. Bearing upon this subject are some facts stated in a paper addressed by the auditor of the canal department of New York to the public under date of Sept. 14, 1865. In this letter the cost of transportation of one bushel or 60 lbs of wheat in lake vessels from Chicago to Buffalo, 1000 miles, and from Buffalo to New York city by the Erie canal and Hudson river 350+150=500 miles is stated as follows:

1861,	Lake freight,		11.53,	Canal	and	River,	exclusive of	tolls,	9.64,	Canal	toll,	5.17.
1862,	"	"	10.49,	"	"	"	"		9.63,	"	"	6.21.
1863,	"	"	7.51,	"	"	"	"		9.58,	"	"	6.21.
1864,	"	"	9.58,	"	"	"	"		12.57,	"	"	6.21.
	Total,		4 | 39.11						4 | 41.42			4 | 23.80
	Average,		9.78						10.36			5.96

Calling the ton 2000 lbs., the average cost of transportation, is per ton, for Lake freight, $3.26, Canal and River, exclusive of tolls, $3.45, tolls, $1.98.

This for Lake freight is 3¼ mills per ton per mile. Supposing Hudson River freight to be 5¼ mills per ton per mile,

which is the usual deduction on freight for New York delivered at Albany, we have for the Canal freight, as follows:

Canal and Hudson River, per ton, as above, average,	$3.45
Hudson River 150 miles, 5½ mills deduct,	.83
Leaves Canal freight per ton,	$2.62

$2.62 per ton for 350 miles is 7½ mills per ton per mile, and $1.98 per ton for tolls is $5\frac{7}{16}$ mills, making together, $13\frac{3}{16}$ mills per ton per mile. The fluctuation in prices was very considerable during the seasons named above. It is not stated how the averages were obtained, whether from the time or from the quantities of wheat conveyed. If the former, then they are probably below the true mean, as prices rule highest when vessels are most in demand. The above is for the single article of wheat. The trade seaward, composed mainly of agricultural products, largely exceeds in tonnage, as stated, that of the return trade. Hence the charges should be greater upon the return trade. They are in fact about double upon the Hudson River, and treble upon the Erie Canal. The above prices for canal, it is supposed, include cost of transhipment, &c., at Buffalo. If they do not, that cost is to be added.

From the preceding it appears that the cost of transportation per mile by lake from Chicago to Buffalo is only fourtenths of the cost per mile upon the Erie Canal as enlarged to its present dimensions, and only one fourth if the canal tolls are included.

As it regards time or speed, it should be understood that the round trip from Buffalo to New York city, and back, is seldom made in less than one month. This indicates that the speed upon the lakes has a much greater ratio to that on the canal, than that of the cost (1 to 2) inverted, showing very conclusively, as elsewhere stated, that the results in the table, under the proportion assumed of 1 to 2 and 2 to 1 are not exaggerated, but fall short of the actual difference between canal and lake and unobstructed river navigation.

Upon the route via Lake Ontario and Oswego the actual

cost to the consumer has hitherto not differed greatly from the cost by the Erie Canal from Buffalo. This is attributable in part to the imperfect connection between the lakes by the Welland Canal, and in part, probably, to the fact that at the mid season, when business is dull comparatively, lake vessels, that at other seasons tranship at Buffalo, extend their trips to Oswego, so that the business of the two routes is to a certain extent in the same hands.

It is stated that the Erie Canal has a capacity much beyond the business hitherto done upon it. This is not easily reconciled with the fact of the very slow movement of boats upon it, not much exceeding on the average one mile per hour. But whether it has capacity for the entire trade between the East and the West is not the question. Is it or can it be made the cheapest and most expeditious navigable route from the lakes to the seaboard? The facts presented show very clearly that it can not. They show that the route via Oswego is superior to it, and that attention should be particularly directed to its further improvement. If at the same time the other routes named can be opened so as to secure a certain and wholesome competition, the effect to both producer and consumer will be most salutary. The relative cost of transportation being of the most importance in this investigation, a reduction of prices given to the gold standard has not been deemed necessary—such reduction would not change materially the conclusions as to the merit of the different routes.

The actual cost of transportation per mile upon natural waters, unobstructed and having sufficient depth, depends, as must have been observed, very much upon the extent of conveyance or length of the voyage.

The Ocean freights from New York to Europe for the years above named, according to the authority quoted above, ranged for the period named, of four years, from 6 to 12 cents on each bushel of wheat, or from two to four dollars per ton, or from two thirds of a mill to one and a third mills per ton per mile. The practical results stated above, although derived from only a single item, but a most important one, indicate

the great superiority of unobstructed natural navigation over the confined channel of a canal on which animal power is used, and they indicate also the importance of avoiding the use of the latter and of giving to the canals as much breadth of surface as possible to prevent injury to the banks and to lessen the resistance. If the canals in question are of such size as to permit vessels like the lake propellers to traverse them by their own means of propulsion, at the rate named, of four miles per hour, it is reasonable to suppose that the cost of transportation will be materially lessened. The failure of the enlarged Erie Canal to lessen the cost of transportation to the degree predicted by its advocates can not, when all the circumstances are fairly considered, be urged with any great force against canals of the size and operated in the manner of those now contemplated.

These remarks are made to show that we have in the comparison made in the table, underrated rather than overrated the disparity between canal, and lake and river navigation. Instead of the proportion of two to one and the reverse, for cost and time, a higher ratio would be nearer the truth for both, if the enlarged Erie Canal is taken for a standard. If the proper relation could be ascertained the general conclusion arrived at would still be the same, only a little more intensified in the one case than in the other. There can be no very cheap transportation by tracking with animal power, and no speed greater than the walk of a horse or mule, which can not be assumed, for the greatest useful effect, at more than two to two and a half miles per hour, or from one-fifth to one-third of the movement of propellers upon the lakes, and one-half their movement in the confined channel of the canal. The actual speed of loaded boats upon the enlarged Erie canal, unobstructed by other boats, is only one and a half miles per hour. This includes the passage of the locks. In assuming, therefore, as is done in forming the table, the proportions of one to two, for speed, and two to one for cost, the canal, it is believed, is allowed all the importance to which it is probably entitled. A ratio nearer the truth, would, we repeat, exhibit the lines or routes which have most canal, in a less favorable light than is shown in the table.

The views we have presented have reference mainly to the navigation of the lakes and their outlets and connections. It has not been our intention, nor is it necessary for the purpose of this essay to enter into an investigation of the railway system as a means of intercommunication between the Lakes and the Ocean. Nor is it necessary to show that for freight which has great weight and bulk in proportion to its value, such as agricultural products, and which does not demand the most rapid transportation, conveyance by water is the cheapest and best mode, provided the disparity in distance is not too great. Such conveyance is, however, limited to, at most, seven months of each year, which is about the extent of the navigable season upon the lakes and canals under review. To supply this deficiency and give rapid transit at all seasons, and to connect the interior with the nearest navigation, railways are indispensable; and extended as the system now is, a still further extension and improvement is now, or will soon be, demanded; and in particular a line of railway is greatly needed which shall be located upon the best ground and the most direct route from Chicago to New York city, especially adapted to the most speedy and cheap transportation of freight, and still another of the same character from Oswego on Lake Ontario to the Hudson.

These lines, for the especial purpose named, would be a great public convenience. The companies owning existing lines between the same extreme points, which are now doing a large mixed business, could, we believe, with great advantage to the public and profit to themselves, unite in forming the new lines mentioned for the purpose of facilitating the transportation of freight.

It will be seen from an inspection of the table, and the remarks which follow it above, how very important is the opening of the route by the way of Lake Ontario and the Erie Canal to Albany; and how very important, also, is the proposed connection between Lakes Erie and Ontario at Niagara, a connection which should be so formed as to overcome the difference in elevation of the lakes, in the cheapest and most expeditious manner, and with dimensions suited to the largest class of lake vessels.

With a connection of this character it is seen that the route from Lake Erie, by the Erie Canal to the Hudson, will not only be excelled in cheapness and in expedition by the route via Lake Ontario and Oswego, but will possess no advantage over the route via the St. Lawrence and Lake Champlain to the same point, and that this latter route is very greatly superior to any other in its relation to the trade between the West and that portion of New England and New York which borders upon or can be reached from the waters of Lake Champlain, a region which is now dependent upon the Erie and Champlain Canals for a navigable communication with the West, and upon the circuitous route of the Sorel and St. Lawrence Rivers for a communication with the valley of the Ottawa.

It will be seen by the table, and by reference to the maps, that produce from the West can be delivered on Lake Champlain by the St. Lawrence route at one-fourth less cost for transportation, and in less time than by the Erie and Champlain Canals, and moreover that the connection of Lake Champlain with the Ottawa valley will be shortened full 90 miles, and the rise and fall lessened 118 feet, an improvement of great importance because of the fact that New England and the valley of the Hudson are depending largely upon it for a supply of lumber, and this dependence must continue for a series of years to come.

The improvement of the navigation of the St. Lawrence River, and its connection with Lake Champlain, as proposed, and the construction of such a communication with Lakes Erie and Ontario at Niagara as will enable the latter lake to become a channel for the trade of the West, will have a most important influence in developing the resources of all that portion of New York lying north of the Mohawk and Oneida Lake valleys, a portion, the most of it, now in a state of nature, but which will in time be filled with a large population.

To the superficial observer the great topographical feature of this portion of New York is the Adirondac Mountains, the highest of which surpasses somewhat in elevation the highest

of the Green Mountains, but the great and important feature is the immense and elevated plateau or table upon which those mountains rest, the mountains occupying only a portion of its surface on the eastern and southeastern part.

This table or plateau covers a space of nearly 5,000 square miles, and is elevated from 1,600 to 2,000 feet above the level of the sea, and from 1,400 to 1,700 feet above the St. Lawrence and Lake Champlain. From its surface the waters flow in all directions forming the Chazy, Saranac, Au Sable, and Boquet rivers on the east, the Hudson and Mohawk with its branches on the south, Fish creek and Black river and the Indian and Oswegatchie on the west, and the Grasse, Racket, St. Regis, Salmon and Chateaugay rivers on the northwest and north.

These waters have a rapid descent to the vallies below, less rapid, however, towards the west and north and northeast, than in the other directions, and they flow from innumerable lakes and ponds which are scattered over the surface of the plateau, and which are so numerous and so nearly upon the same level, that with short carrying places the entire extent of the plateau from its northeast to its southwest part can be easily traversed in light canoes. These lakes and ponds form reservoirs which retain the flood waters. Their elevation lessens the waste from evaporation, and the rivers leading from them are rendered remarkably equable in their flow at all seasons, and afford in this view and in view of the surface drained and greater rain fall in the vicinity of the mountains and their great descent, a water power such as no other equal portion of the country can boast either in location, in character, or in amount. This great power, exceeding that of millions of horses, is situated in a most healthy region, covered, the most of it, by a dense forest, where the land is now held to be of but little value comparatively.

This region is girded by the improvements we have described, which sweep its base upon all sides, and by lines of railway now in operation, and will have, when the Saratoga and Sackets Harbor road is built, a line passing centrally through it. It has great mineral and other resources, and must rapid-

ly come into notice in the future and perform a most important part in connection with the industry of the country, and of the state to which it belongs.

The improvements proposed should not be viewed as having any injurious tendency to divert the trade or commerce of the West from our own seaports. Montreal and Quebec, are both inaccessible from the sea during the long Canadian winter, and the navigation of the St. Lawrence to the ocean being liable to be obstructed by fogs and otherwise rendered difficult and dangerous; by the heavy tide currents, can never probably, in view of the fact that the capital or wealth of the country is, and will continue to be, elsewhere centered, seriously interfere with the commerce of our maritime cities, but, on the contrary, the opening of these communications and others direct with the Canadas, will render the latter more dependent and tributary to the growing cities of the States, and contribute largely to the removal of those political barriers which now stand in the way of their future prosperity and our own.

When the Erie canal of New York was projected and arguments were needed to show the importance of its extension to Lake Erie, it was that urged if the Lake Erie trade was permitted to descend to Lake Ontario it would pass on down the St. Lawrence. The Welland canal was afterwards built with locks much larger than those of the Erie canal, and the Oswego canal was also constructed and no such result followed. When arguments were again wanting to justify the enlargement of the Erie canal throughout its entire length to Buffalo, the danger of loss of trade in the direction named, was again urged in opposition to opening the better and cheaper route by Lake Ontario and the Niagara canal. The Welland canal has since been enlarged to its present dimensions, and the Oswego canal also enlarged, and the St. Lawrence canals constructed, and no such dreaded result has followed, but on the contrary, the vessels passing the former have been mainly destined for Oswego, and those carrying wheat and corn to Canadian ports have done so principally for the purpose of having those articles converted into flour

and meal to be again shipped with Canadian products, for our own ports and markets. It is worthy of note that the interest which has opposed, and hitherto so successfully, the opening of the Ontario route, by the construction of the Niagara canal, opposed also the opening of channels necessary to attract and divert the trade of Lake Ontario to our own seaports. It opposed the construction of the Oswego canal and its subsequent enlargement, an improvement of importance in view of the use made by the Canadas of this channel as a means of communicating with the ocean in preference to the St. Lawrence, a use allowed to them on payment of a small transit duty, and which has given us much of the Canadian sea going trade.

The very great facilities and inducements presented by the enlargement of the Welland and building of the St. Lawrence canals, as stated, in connection with the right of free navigation of the St. Lawrence under the Reciprocity treaty, has not operated seriously, or in any degree worthy of note, to divert the trade of the lakes in that direction. The entire tonnage which passed from our own territories to the lower St. Lawrence during the first six years of the operation of that treaty, did not exceed, as stated on the floor of the Senate, during the discussion upon it, 12,000 tons in 40 vessels, the largest portion of which, it is evident, could not have been sea going vessels, and were not designed for the trade as they did not return to the waters where they were built and loaded.

In this connection it may be proper to state that the Erie canal of New York, from its advantageous location, is no longer, as at first, used mainly for the transmission of the products of the state within which it is situated. Of the vast tonnage which annually finds its way to tide water by this canal, *four fifths* is from the states west of New York. In 1862 the relation of the tonnage from the two sources was as 2,594,837 to 322,257. This great change and difference which is annually increasing, has imparted to that work a character of so great importance in a national view as to cause no little anxiety to the people of those states who are

compelled to use the canal as a channel for the transmission of the products of their labor.

The general government when solicited to co-operate or engage in its construction declined to do so. That it was wise thus to decline may now with propriety be questioned.

So important both to the East and the West is cheapness of transit that fears are entertained and complaints made of undue exactions. If the state of New York is blameless in this respect, and has imposed no heavier tolls than is proper, she has given just ground for complaint in steadfastly opposing through her legislature, and in other ways, the opening of the cheaper route between the East and the West, through Lake Ontario, endeavoring thus to force the immense trade of the West through the costly and tedious channel of the Erie canal from Buffalo to Albany, a course injurious to the interests of a large population at the East and at the West, and injurious, also, to the best interests of that state and of its great emporium.

Having said all that we proposed to say upon the question of the routes from the lakes to the seaboard, we now will give attention to those connecting the lakes with the Mississippi, and in what we have to say upon this subject we shall consider only the two more important lines leading from Lake Michigan in Illinois and Wisconsin.

The leading features of these have already been described. The Illinois and Michigan canal as projected, was to have been fed from Lake Michigan, but the cost of cutting down the summit of 25 feet was too great for the means at command, and as it could by reducing it in part be supplied, or nearly so, from a tributary to the Illinois river, and the deficiency, if any, made up by pumping from the Chicago river, the plan of supplying from Lake Michigan was laid aside. This navigation (the canal and Illinois river) connects with the Mississippi but a few miles above the mouth of the Missouri, and not far from the city of St. Louis.

The Wisconsin improvement from Green Bay is, in its present condition, with the exception of the short canal at the Portage, simply a slack water navigation very imperfectly

accomplished. It connects with the Mississippi near Prairie Du Chien 290 miles in a due north direction from the mouth of the Illinois river, and 400 miles, nearly, following the course of the Mississippi which has in this distance a descent of about 320 feet, 21 feet of which is at the Des Moines rapids, and 22 feet at the Rock Island rapids, indicating a strong current, which, but for its sinuosities, would be unfavorable to navigation, and such is the case with all of the Mississippi waters and its tributaries above the mouth of the Ohio.

The two lines in question in Illinois and Wisconsin connect with the Mississippi at points so remote as not to interfere materially the one with the business of the other.

The latter line will derive its support mainly from that portion of the Mississippi valley situated above the mouth of the Des Moines river or the south line of Iowa, while the former will have, in addition to the valley of the Mississippi below, the trade from the Missouri river and valley which is daily and rapidly increasing, and which will be more than sufficient, probably, to give to that channel all that its capacity will enable it to perform.

The proper dimensions to be given to these improvements is a question of importance. A little reflection will show that they should be ample to accommodate the larger class of vessels which navigate the Mississippi. These canals are destined to perform a most important part in relation to the trade between the east and the west, and also in relation to the trade between the lower Mississippi and the lakes. The large population which is gathering about the upper lakes will receive their supply of tropical productions by the way of the Mississippi, and lumber and other articles from the lakes must find their way back in exchange.

The navigation of the Mississippi and its tributaries is of a character to require boats of a peculiar construction. They are necessarily of light draft, and are built with slender frames and with as little material as possible. Not being exposed to the heavy strains of the sea, great strength is not demanded. To obtain capacity they are made broad and long. They are propelled by steam of a high pressure, a pressure of

130 to 150 pounds on each square inch of the boilers, and the engines, to avoid weight, are non-condensing. But few of these river vessels have a draft exceeding four feet. The canals leading from lake Michigan are not adapted to receive these vessels. There is consequently a transhipment where the navigation of the canals meets that of the rivers, and another where the former meets that of the lakes. This breaking of bulk or transfer of freight is costly, consumes time and is an injury to the articles conveyed. There need be, and should be, but one transhipment. The canals should be enlarged, and the navigation directly connected with them improved, so as to accommodate the larger of the river vessels and that speedily. The country throughout the Upper Missippi is filling up rapidly, and long, ere these improvements can be made, they will be wanted. They are even now needed. The canals should have at least six feet depth of water. with a suitable width, and the locks should be not less than 300 to 350 by 70 or 75 feet. The writer had occasion not long since to take the dimensions of many of the principal steamers which navigate the Upper Mississippi, and the above size for the locks is given in view of those measurements. These dimensions accord also with the recommendation of Messrs. Gooding and Preston, engineers, published in the proceedings of the canal convention, already referred to.

With its summit lowered to the level of Lake Michigan, as originally designed, the lockage upon the Illinois and Michigan canal will be reduced to 142 feet, making the total descent upon the canal and the Illinois river 180 to 190 feet. The river has an average descent of one and a half to two inches, nearly, per mile, and because of the scant supply of water at times is less efficient in its present condition than the canal. The lowering or removal of the summit and introduction of the water from Lake Michigan, with such improvement by dredging or erection of piers as is required in the river below, will render the navigation what it should and must be to meet the requirements of trade.

The line in Wisconsin has 298 feet total rise and fall from Green Bay to the Mississippi, a distance of about two-thirds

that of the Illinois and Michigan improvement, the most of which, 160 feet, occurs upon the outlet of the Winnebago lake where it is overcome by a series of dams and locks. In perfecting this improvement a greater extent of canal is demanded in place of the channel of the upper Fox river now used. This is needed to shorten distance and improve otherwise the navigation, and the Wisconsin river for a portion of the distance where the descent is greatest must also be improved.

The construction of canals becomes an object only in cases where there are large extents or lines of natural navigation to be united, and this is peculiarly the case with respect to the improvements under consideration. Having the great Lakes on one side and the Mississippi with its tributaries on the other, their construction is indispensable. As a general means of intercommunication for the conveyance of both freight and passengers, railways are in most respects superior, but for the transportation of agricultural products and of other bulky and heavy articles where cheapness of transit is an object, and time of not so much importance, and particularly where they unite natural navigations which are extensive, preventing transhipment, they become a necessity, although not available more than seven months in the year, and such is the case, as we have shown, with the canals leading west from Lake Michigan, and such also is the case with those shorter ones required to perfect, as already described, the communication between the lakes and the eastern seaboard. The canals now in operation upon these latter routes, imperfect as they are, form, in connection with the navigation of the lakes the cheapest mode of conveyance, a cheapness which is attracting the trade of the interior strongly to the shores of the lakes. It is this which, in conjunction with the railways, is building up our lake cities, and is yearly diverting the trade of the Mississippi valley from points lower down upon that river, to our eastern and northern marts, and it is this which will contribute greatly to render what is now known as the northern railway route to the Pacific, a route leading from both the St. Lawrence and Mississippi basins, superior, in connection with the other great advantages

which it possesses, to other projected routes designed to unite by railway the oceans that bound us upon the east and upon the west.

The important relation which the navigation of the lakes and of the upper Mississippi bears to this proposed thoroughfare will justify us in dwelling somewhat upon its character, and its future influence upon the internal commerce and growth of the country.

This route to the Pacific, by which is understood the route via St. Paul and the upper Missouri across to Clark's branch of the Columbia and following the Columbia to the sea, or diverging therefrom to the waters of Puget Sound or Admiralty Inlet, was brought to the notice of the public prior to the making of the government surveys, in a series of articles from the pen of the writer which were published in the Railroad Journal and subsequently in book form, and it was therein shown to possess advantages over other proposed routes lying further south in the following particulars:

1. Its direct connection at its eastern extremity with the cheap navigation of the great lakes and the St. Lawrence chain of waters, which reach nearly half way from the Atlantic to the Pacific.

2. Its terminus on the Pacific at a point or points more favorable for concentrating the trade of that ocean and of the interior, than any other points further south.

3. Its location along the great valleys of the Mississippi, Missouri and Columbia rivers, which with their tributaries, many of them, are navigable for long distances, a navigation which is of the utmost importance in connection with the proposed railway in facilitating its construction, and giving to it support when completed.

4. Its connection with the navigation of the Red River of the north, a navigation which extends through a fertile valley into the British possessions, uniting there with the Assiniboine and Saskatchewan rivers, which flow through a region having large agricultural and mineral resources, as ascertained by explorations recently made under the direction of the Canadian government.

5. In the comparative evenness of its surface and consequent cheapness, and in the lowness of the gradients upon it, the line crossing the divide of the Rocky Mountains, where the sources of the Missouri and Clark's branch of the Columbia interlock, the back bone of the mountains being there broken down so as to be overcome by a railway with gradients not exceeding about forty feet to the mile, and with its main summit 2500 feet lower and coast range summit, if the line is carried across it, 4000 feet lower than the Nevada summit, upon the route through the South Pass to San Francisco.

6. Its freedom from deep snows in winter, the obstructions from this cause being greatest upon the route by the 42d parallel leading through Salt Lake to San Francisco. This difference in the character of the two routes is produced by the greater elevation of the latter route and narrowness of its defiles, the absence of moisture in the winter months in the atmosphere of the northern route to produce snows.

7. In its rich mineral productions excelling probably in this respect other routes. Its gold fields not being surpassed, if, indeed, they are equaled, by those of California, and being better supplied with timber, water and fuel, coal being now mined in Washington territory on the Pacific, and lignite of a superior quality having been found over an extensive section of the route and in its vicinity, and upon the Sackatchewan valley north of the national boundary east of the mountains.

8. In its superiority over other routes in its capability of sustaining a greater population, and contributing more largely to the support of a railway, as evidenced by the greater quantity of game found within its limits, and its being the abode of the greatest number of Indians to be found between the Mississippi and the Pacific, consisting of the Sioux, the Crows, the Mandans, the Blackfeet and the Flatheads, all except the Mandans, being large and powerful tribes. All these find an easy and comfortable support in what the country can furnish, which cannot be said of the resources of any other route to the Pacific.

9. It constitutes the most direct and feasible route within

the United States to connect with the shortest line on the Pacific to the ports of China, Japan and eastern Russia, it being about fifteen hundred miles nearer to the ports of China than the route from San Francisco by the Sandwich Islands, and being coastwise, offers frequent opportunities for obtaining supplies of fuel and food, thus increasing the freighting capacity of vessels without deviating greatly from a direct course.

10. It will probably be found the cheapest and best interior route from the Sacramento valley in California, where most of the population of California is congregated, and also from San Francisco, to the portion of the Union which has the densest population, and to the city of New York, whenever a railway shall be carried from the Sacramento valley to the Columbia to meet it. Such a railway to connect the populations on the Pacific is more important in a military view for the defence of that portion of the Union than a line from the Mississippi to the Pacific.

11. The northern route is superior in the opportunity it affords for connecting the fertile portions of Western British North America with our own markets, and giving to the Canadas as well as to the States the best route to the Pacific. The Canadas having now a population of over four millions, a route which will best accommodate this population and our own, will be better sustained, and business upon it will be done more cheaply and efficiently.

Such is the general character of the climate upon the northern route to the Pacific, that there is a gradual amelioration in passing to the west from Lake Superior, and this, notwithstanding the rise of 5000 feet to the divide of the mountains. At Puget Sound in latitude 47° north the mean annual temperature is but little different from that of Norfolk in Virginia, and this mild character of the climate extends so far to the north, that wheat is said to mature in the latitude of 60 degrees on the Pacific, 700 miles from the international boundary, and the same is stated of the country in the vicinity of Edmonton which is situated near to and east of the mountains in latitude 54°N. nearly, and elevated 1500 to 2000 feet above the sea.

When the merits of the northern route were first disclosed in the publication mentioned above, but little was known by the public in regard to it. The only explorers of note were Lewis and Clarke, and their journal had never been reprinted, except an abbreviated edition in the family library, and as the original was published in 1814, several years after the death of Lewis who was the leading man of the expedition, the map accompanying it, was very defective. So general was the impression of the impracticability of the northern route from its elevation and from snows, that but for the timely representations of the writer it is very possible it would not have been examined, when the government surveys were made. The government prior to instituting those surveys consulted various gentlemen as to the routes proper to be explored, none of whom, it is evident, understood fully the true character of the country upon the northern route. One in particular who had made explorations to the Red River of the North, and to the Rocky Mountains south of the Platte, could suggest no route worthy of examination north of the South Pass, and it is well known that the most prominent of later explorers advocated a route as the best still farther south, by what is known as the Buffalo or Cochatopee Pass, and thence to Walker's Pass in the Nevada range, and this, after it had been clearly demonstrated in the then published memoir of the writer, to be the most impracticable of all the proposed routes. That memoir was submitted, at the instance of the Hon. Robt. J. Walker, who took a deep interest in the subject, to the then Secretary of War in manuscript, and was soon after followed by an elaborate report from the Secretary upon the topography of the country between the Mississippi and Pacific, and when Major Stevens was directed to make an examination of that route the belief was general that such examination would prove its entire impracticability, and so prepossessed was the Major himself with the idea of encountering deep snows and an elevated summit, that he remained some time at Fort Benton to procure dogs and sleds with which to cross the mountains. But after traveling for three days and finding no snow, and no indications of any, he re-

turned to Fort Benton for his horses, which he had no difficulty in subsisting upon the grass of the country, the snow at the main divide of the waters not exceeding one foot in depth, and this for a distance of only six or eight miles. The reconnoisance of Major Stevens and subsequent examinations of Lieut. Mullan and others, completely confirmed the correctness of the representations and conclusions as presented in the memoir. The elevations as given in the profile were in no instance underestimated, and in this particular there was a remarkable coincidence, while the map which was constructed from the verbal descriptions of Lewis and Clark was even more full and correct than the one first prepared by Maj. Stevens. These remarks are made more especially because of the little notice taken in the government reports of that most valuable of all, the explorations made between the Mississippi and Pacific, by Lewis and Clarke in 1803 and 1804, an exploration the most remarkable of any, considering the time and circumstances and cost to the country, and amount of information obtained, as shown by the use of it made by the writer in his exposition of the northern route.

That exposition elicited, at the time, letters of commendation from many gentlemen distinguished for their scientific and professional acquirements and elevated views, several of whom have since paid the great debt of nature. Among the latter are Prof. Renwick and W. C. Redfield of New York city. Prof. Silliman sen., of Connecticut, Prof. Thompson of Vermont, Gov. Doty of Wisconsin, Gov. Simpson of the Hudson's Bay Company, H. B. Schoolcraft of Washington, and others. These and many others now living all concurred in the conclusions arrived at in the memoir. Prof. Renwick pronounced it a "most able argument," subscribes to the importance of a terminus on Puget Sound, and says that he cannot avoid concurring in "the conclusion that the severity of the climate and dangers of interruption by snow, do not afford such objections to a northern route as will outweigh the advantages it probably possesses over any of the other proposed lines of communication between the

States of the Atlantic and the Pacific." Mr. Redfield said "it was by far the most direct and convincing elucidation of the important question" he had seen. Prof. Silliman said that he had "read it twice attentively" that it "embraced from the best authorities a comprehensive and exact survey of the topography, climate, productions, &c., of the vast region in question in a lucid and satisfactory manner," and was "a production of great merit." Prof. Thompson, who had given great attention to the subject of meteorology, expressed the opinion that "the obstructions from snow will be even more formidable in the middle and southern passes than in the northern," and for the reason that "the defiles of the former are narrower and deeper and more elevated than the northern." Gov. Simpson testifies as to the climate and productions, having crossed the mountains three times north of the latitude of 49°, but could not subscribe to the correctness of the estimate of elevation of the main divide of the mountains, since proved to vary but little from the truth, by the government surveys. He believed the divide to be higher. He expressed great interest in the undertaking, fully appreciating, to use his own words, "the vast advantages that must arise to the United States and adjoining British possessions, in the event of this magnificent scheme of a railroad being carried into operation."

Gov. Doty, said that he had read with great interest the memoir, and "deemed the statements and arguments in favor of the northern route conclusive." Mr. Schoolcraft most fully endorsed the conclusions of the writer. He said there was "one consideration to be urged in favor of a northern route over any other, which outweighs every view of which the topic is susceptible. It is the preference of soil, climate, and meteorological phenomena. The northern route will pass through tracts which are capable of continuous settlement. Much of the soil is first rate farming lands, which will bear corn and all the cereal grains! and these lands can be cultivated without *irrigation*, the great objection to the southern routes. It abounds in lively and flowing streams, which will sustain arts and manufactures, and no

part of the world is better suited to grazing. It has been the error of geographers from A. D. 1600, that all of North America beyond certain latitudes is filled with Serbonian bogs and Cimmerian darkness. The veil is lifted up, and truth let in precisely in proportion to the march of true discovery. Once Michigan, the best wheat state of the west, was deemed a swamp unfit to be given to the soldiers of the war of 1812 for bounty lands. I found corn and wheat good and reliable crops on the sources of the Mississippi up to the latitude of 49°, and Red River valley of Hudson's Bay, north of that latitude is known to be a fine agricultural settlement."

These opinions, in accordance with the conclusions in the memoir, have all been verified, as stated, by the government surveys, the results of which have been placed before the public in so full a manner in the several reports of Lieut. now Gen. Saxton, and of Gov. Stevens and his assistants, that it is only necessary in this place to refer to them.

Since, however, these explorations were made, others have also been made from Lake Superior westward to the Pacific, north of the international boundary. The most prominent of these was the one conducted by Prof. H. Y. Hind, in 1857 and 1858.

This exploration disclosed the fact that there is a "broad strip of fertile country, rich in water, woods and pasturage," "possessing rich stores of lignite coal, iron and salt," "capable of settlement and cultivation," extending from near the Lake of the Woods, 200 miles northwest of Lake Superior, to the passes of the Rocky Mountains. The latest explorers of this region, Lord Milton and Dr. Cheadle, report that "all the country between the Saskatchewan and Athabasca is fertile. It will grow wheat and potatoes and all the coarser grains in abundance, and contains large quantities of lignite coal, of which wide seams are laid bare by the water courses."

The region in question is watered mainly by the Assiniboine and Saskatchewan rivers and their tributaries, and the group of lakes of which Lake Winnipeg is the principal, presenting in the aggregate a natural navigation of one thousand to fifteen hundred miles in extent.

Between these rivers and the Missouri are level or nearly level plains, broken only by the elevation known as the Coteau-du Missouri, and hills appertaining thereto, over which branch lines of railway, diverging from the main line at suitable points, can easily be constructed. This level and favorable character of the surface does not prevail in the same latitude west of the mountains, and judging from the examinations of Dr. Hector, and Lieuts. Palmer and Mayne and others, the country in British Columbia offers no very favorable ground for a railway to the Pacific, unless it be as far north as the valley of the upper Fraser, and of Stewart's and Simpson's rivers, a route which it is not certain can be reached by a sufficiently practicable pass in the mountains leading from the valley of the North Saskatchewan. South of this are two favorable passes described by Captain Palliser, the Vermillion and Kananaski in about lat. 51° N., but there is no apparently favorable route leading from these to the Pacific.

The conclusion is unavoidable, from the preceding that the only truly feasible route for the great highway leading from the most populous region on the Atlantic in the United States, to that section on the Pacific coast, which in time must also become the most populous, and which passes in its intermediate portions over ground the most favorable and capable of yielding it the largest support, is the one known as the northern route to the Pacific. Upon this route the most remarkable changes and developments are about to take place.

It is in truth, probably, the only practicable route using the term in its proper sense. Thousands are now rushing to the gold fields which fill a large space traversed by it, many of whom will remain there, attracted by the mildness and salubrity of the climate. The liberal grant made by Congress of lands for a railway upon it will induce capitalists in this country and in England to embark their means in its construction. To capitalists in the latter country it presents greater inducements than any other route because of its importance to the Canadas. Unlike all other projected lines, its construction will be expedited and cheapened because accessible at so many points, on both sides of the mountains, by the navigation

of the rivers, and settlements will be rapidly formed along its whole extent. The Red river valley will become accessible by it, and also the valleys of the Assiniboine and Saskatchawan. The Yellowstone, of which we have not elsewhere particularly spoken, and which with its Big Horn branch is navigable for several hundred miles, will attract many to its borders. The trade of these vallies will, much of it, come to Lake Superior. In the mountains and beyond them, along Clark's river and its branches, and in the valley of the Columbia, settlements will be made such as are now forming upon the Pacific. The railway will probably have at that extremity two termini, one on the Columbia and one at Puget Sound or Admiralty Inlet.

At these points transhipment to and from Eastern Asia will take place. Upon one of them will arise a city which will have the same relation to the trade of the Pacific as New York now holds to the trade of the Atlantic. The people in the valleys of the Missouri and Upper Mississippi will get their Asiatic productions, their teas, their spices and oils, and other articles, by railroad from the Pacific. These, when they reach the navigation of the Missouri, which approaches to within seventy miles of the divide of the mountains, will be put upon arks or rafts of lumber, and thus be floated down and distributed at a cheap rate throughout the valley of the Missouri and Mississippi.

The navigation of the rivers, as already stated, is a remarkable feature in connection with this route. Within ninety miles of the main divide of the mountains, on the west side, are the navigable waters of the Bitteroot branch of Clark's river, and from this point an improvement by short canals and locks in some half a dozen places only, extends the navigation to the Pacific. All of these rivers have a remarkably uniform flow. Their waters are kept up in the months of July and August, after the effect of the winter and spring rains has passed off, by the melting of the snows upon the more elevated ranges.

While thus compelled to give the preference, as we have done, to the Northern route for a railroad to the Pacific, it

must not be inferred that the navigation of the lakes will not be benefited, and greatly so, by the opening of any other route. On the contrary, the route now in course of construction through the South Pass of the Rocky Mountains, by the way of Salt Lake to San Francisco, stands in nearly the same relation to it as the Northern route, and if it is not eventually as large a contributor, is destined to assist greatly in expanding the business of the lakes far beyond its present limits. A considerable portion of this route will soon be in operation, while the other is still awaiting the action of capitalists under the very liberal charter and grant by the government, of forty alternate sections of land per mile in the territories, and twenty alternate sections in the States through which it passes.

The point where the former will at first meet the cheap navigation of the lakes is Chicago, but should a line of railway be carried from near the South Pass to Lake Superior, its connnection with the lakes will be shortened 150 to 200 miles.

A glance at the map shows very clearly the advantage which Lake Superior possesses in reference to a connection with a railway to the Pacific. It will be seen that its western extreme is four degrees of longitude west of the west shore of Lake Michigan.

Although the opening of the routes named to the Pacific will contribute largely to swell the business of the lakes, and of Lakes Michigan and Superior in particular, this resource is not needed to bring to those lakes a vast amount of trade, such an amount as to render absolutely necessary the improvements we have described.

The country all around Lake Superior, although not well adapted to cultivation, is remarkably rich in minerals. Upon its south side, copper and the ores of iron are now mined in large quantities, and the supply appears inexhaustible. From the iron mines alone there was sent last year (1864), to distant markets, 235,000 tons of iron ore, enough from this item alone to freight nearly a thousand vessels of 240 tons each. The shipments of copper from this region have averaged for the last four years over 10,000 tons per year.

This region is rapidly increasing in population, and this increase is going on at a steadily advancing rate all through Wisconsin, Illinois, Minnesota, Iowa, Missouri, Kansas, Nebraska, &c. Wisconsin, Minnesota, Iowa and Nebraska, will have, probably, by the next census, two millions of inhabitants. A little reflection upon what has occurred in this respect in the past will throw light upon the future.

Before the Erie Canal of New York was opened, forty years since, but few settlers, comparatively, had found their way to Indiana and Illinois, and the best lands in those States could be bought at the government price of $1.25 per acre. The settlement of those states rapidly increased after the event named, and in 1860 Indiana had 1,350,428, and Illinois 1,711,951 inhabitants, and farm lands had advanced to 20 and 30 dollars per acre.

Wisconsin, the settlement of which was commenced about 1835, soon after the Black Hawk war, had in 1860, 776,000 inhabitants, and lands in that state at the latter date had advanced from the government price to the same rates per acre.

The States west of the Mississippi are filling up more rapidly even than did the States named. There can be no mistake about this. The observations of the writer made in the latter named States, within the present year (1865), convinces him that if the means were now at command, and ready to be applied, the channels pointed out as necessary to the trade of those States, could not be properly opened or improved in time to meet the wants of the people of those states.

In these improvements the East and the West are alike most deeply interested. The manufacturers of New England no less than the farmers upon the prairies of the West. Any improvement which shall lessen the cost of transportation of agricultural produce between these sections will be a blessing, the value of which can not be calculated. It will give new life and vigor to the industry of a very large extent of country at the West, now burdened with the heavy expense of a long road to market. The competition which will be created will be most salutary and is greatly needed, and a

new impetus will be given to the growth of our cities upon the seaboard.

It will cheapen subsistence in one section and add to the comforts of life of the other, and both the producer and consumer will enjoy in a much larger measure than at present the fruits of their labors.

NOTE.—A paper by Geo. H. Perry, C. E., of Ottawa City, on Canadian improvements, which has come under notice since the preceding was put in type, gives dimensions of some of the locks, &c., on those improvements, differing from the statements from other sources.

Mr. P. gives the size of the Welland locks 180 by 26½ feet, and the Rideau Canal locks 133 by 33 feet. He supposes that only twenty-two miles of canal will be necessary on the Ottawa route between Lake Huron and Lake St. Louis, and says, there are now six locks between Ottawa City, one of which is only 96 by 19 feet, with 4½ feet depth of water.

He also states that the Galops and Point Iroquois Canals, on the St. Lawrence, have been connected by a canal 2⅝ miles without locks.

It is proper to state that the enlargement of the Champlain Canal to the size of the enlarged Erie Canal is in progress, and not completed as may be inferred from the text.

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